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THE WORK OF THE SAN ANTONIO EXPERIMENT FARM IN 1915.

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INTRODUCTION.

The work of the San Antonio Experiment Farm[1] was continued in 1915 along the same general lines as those indicated in previous reports.[2] The principal lines of work were the rotation and tillage experiments; horticultural experiments, which include the testing of a large collection of peaches, plums, grapes, citranges, and other fruits; the study of new ornamental trees, both native and exotic, which might be utilized in making the home surroundings more attractive; the testing of varieties of cotton and methods of growing the crop; variety tests and cultural methods for corn; and variety tests of field peas.

The experiments with single-stalk cotton culture were continued in cooperation with the Office of Crop Acclimatization and Adaptation Investigations. This method of planting continues to indicate its superiority over the old methods. As a part of the experiments with field peas, which have proved to be a valuable winter-forage and green-manure crop, about 60 varieties were tested. The experiment farm was increased in size by an additional 3 acres of land, lying immediately north of the main tract, to be used as a building site and a garden in which to assemble a collection of the native trees and shrubs. The arrangement of the fields and the location of the experiments in 1915 are shown in figure 1.

[1] The San Antonio Experiment Farm comprises about 125 acres of land situated about 6 miles south of San Antonio, Tex. The tract belongs to the city of San Antonio and is leased to the Department of Agriculture. An additional 3 acres, lying immediately north of the main tract, has recently been deeded to the department for use as a permanent building site. About 80 acres of the land are under cultivation, and 6 of these are irrigated. The farm is under the direction of the Office of Western Irrigation Agriculture of the Bureau of Plant Industry and is maintained from the funds of the Department of Agriculture.

[2] Hastings, S. H. The work of the San Antonio Experiment Farm in 1912. *In* U. S. Dept. Agr., Bur. Plant Indus. Cir. 120, p. 7–20, 7 fig. 1913.

Hastings, S. H. The work of the San Antonio Experiment Farm in 1913. U. S. Dept. Agr., Bur. Plant Indus. [Misc. Pub.], 15 p., 5 fig. Sept. 9, 1914.

Hastings, S. H. The work of the San Antonio Experiment Farm in 1914. U. S. Dept. Agr., Bur. Plant Indus., West. Irrig. Agr. 5 [Misc. Pub.], 16 p., 6 fig. 1915.

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SEASONAL CONDITIONS.

The season of 1915 was abnormal in many respects. An unusually late freeze occurred on March 22, when a minimum temperature of 24.5° F. was recorded. (Table I.) This resulted in practically an entire failure of the peach crop on the experiment farm and in the San Antonio region generally, and did some damage to annual crops by injuring stands and retarding growth. Abnormally heavy precipitation occurred in April, the total for that month being 9.05 inches. The precipitation during January, February, and March was slightly below normal, but was sufficient to keep well-prepared soil in good condition for planting. The precipitation for May was practically normal, but there was no rainfall in June, and that during July was scanty. In spite of these unfavorable conditions, fair yields of Indian corn and of sorghum for forage were obtained. Cotton was damaged by the drought of June and July, and as a result the yields of this crop were somewhat below the normal. Though the first part of August was very dry, rains came during the last few days of that month, and the total precipitation for August and September was above normal. This resulted in a good yield of late forage crops. The precipitation during October, November, and December was light, making conditions rather unfavorable for fall-planted crops. On the other hand, the weather was favorable for farm work, which made possible the preparation of much land for the following year. The total precipitation at the experiment farm was 26.64 inches, which is slightly more than the average for the 9-year period, 1907 to 1915, inclusive. The total evaporation from a free water surface was 63.92 inches, as compared with an average of 66.51 inches for the same 9-year period.

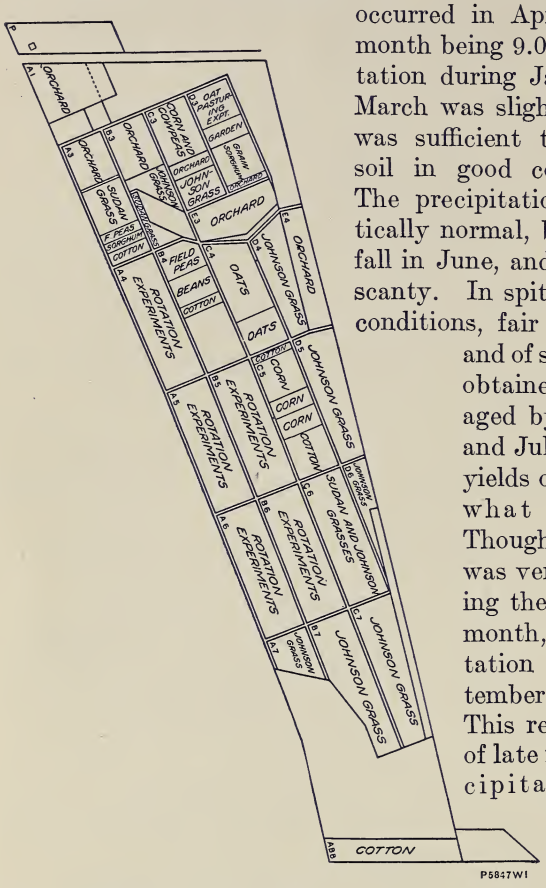

FIG. 1.—Diagram of the San Antonio Experiment Farm, showing the arrangement of the fields and the location of the experiments in 1915.

The minimum temperature during the winter of 1914–15 was 21° F., which is somewhat higher than normal. No severely cold weather occurred, though the mean temperature during January was more than 5 degrees lower than the mean for the 9-year period from 1907 to 1915. The first frost in autumn occurred on November 15, when the minimum temperature recorded was 27° F. The total frost-free period in 1915 was 238 days. Absence of extremely cold weather, together with the fact that the month of January was somewhat cooler than usual, favored the survival of practically all of the tender perennials. Even the sour oranges and the lemons came through the winter with scarcely any injury, for the first time since they were planted in the spring of 1908.

TABLE I.—*Summary of meteorological observations made at the San Antonio Experiment Farm, 1907 to 1915, inclusive.*

PRECIPITATION (INCHES).

Item.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Average for 9 years, 1907 to 1915	0.55	2.06	1.68	3.95	2.89	1.35	1.17	1.97	2.38	2.82	2.64	2.05	25.51
For 1915	.48	1.72	1.31	9.05	2.50	0	1.08	3.48	3.21	1.90	.41	1.50	26.64

EVAPORATION (INCHES).

Average for 9 years, 1907 to 1915	2.67	3.03	4.34	5.33	6.54	8.43	9.61	8.99	6.93	5.19	3.10	2.35	66.51
For 1915	2.26	2.81	3.37	3.36	6	8.99	11.33	8.47	5.29	5.46	4.07	2.51	63.92

DAILY WIND VELOCITY (MILES PER HOUR).

Highest:													
1911–1915	10.4	15.9	9.1	10.6	9.2	11.9	12.1	12.1	6.6	8.5	9.5	8	15.9
For 1915	7.7	9.9	5.8	6.6	7.9	6.8	6.6	8.2	5.8	5.1	6.1	7.1	9.9
Lowest:													
1911–1915	.5	.1	.6	.3	.1	.5	.9	.5	.4	.3	.4	.3	.1
For 1915	.9	.7	.8	.3	.1	.5	1.5	.6	.8	.3	.5	.7	.1
Mean:													
1911–1915	3.4	4.1	3.8	3.6	3.5	3.8	4.2	3.4	2.9	2.7	2.6	2.8	3.4
For 1915	3.0	3.1	3.0	2.6	2.6	3.9	4.2	2.5	2.5	1.7	2.5	3.1	2.9

TEMPERATURE (°F.).

Absolute maximum:													
1907–1915	88.5	87	95	102	103	108	108	105	104	98	88	82	108
For 1915	74	79	90	85	93	102	101.5	102	96	95	88	81	102
Absolute minimum:													
1907–1915	12	13	24.5	32	39	56	60	56	41	29	15	17	12
For 1915	21	27	24.5	35	52	58	60	56	58	41	27	23	21
Mean:													
1907–1915	52.8	54.1	61.9	67.8	75.1	82.3	85.1	84.7	79.7	69.6	60.7	50.2	68.7
For 1915	47.6	56.5	52.2	67.2	75.6	83	85.7	83.2	80.2	71.8	62.8	54.8	75.3

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Frost-free period.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		°F.		°F.	*Days.*
1907	Feb. 8	29.0	Nov. 12	32.0	277
1908	Feb. 20	24.0	Nov. 14	29.0	268
1909	Feb. 25	30.0	Dec. 6	31.0	284
1910	...do....	26.0	Oct. 29	32.0	246
1911	...do....	29.0	Nov. 13	31.0	261
1912	Feb. 27	30.5	Nov. 2	29.5	245
1913	Mar. 17	26.0	Oct. 27	29.0	224
1914	Mar. 23	29.0	Nov. 20	31.0	242
1915	Mar. 22	24.5	Nov. 15	27.0	238

The meteorological observations made at the experiment farm are carried on in cooperation with the Biophysical Laboratory of the Bureau of Plant Industry. Table I gives a summary of these observations for 1915, together with the means for the 9-year period from 1907 to 1915, inclusive.

ROTATION AND TILLAGE EXPERIMENTS.[1]

The rotation and tillage experiments, which occupy 99 quarter-acre plats, were continued without change. The results from these experiments continue to increase in value each year and have already thrown much light upon the agricultural problems and the agricultural possibilities of the region. A view of a part of the field used for these experiments is shown in figure 2.

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FIG. 2.—A portion of the field used for rotation and tillage experiments at the San Antonio Experiment Farm, showing something of the topography of the San Antonio region.

On account of cold weather at planting time, some difficulty was experienced in 1915 in securing good stands of corn and milo. The necessity for replanting the milo several times made the crop so late that it was subjected to unusual damage by the sorghum midge. As a result, the yields from this crop were the lowest obtained since the crop was included in the rotation experiments.

While the yield of corn was much lower than in 1914, it was somewhat above the average for 7 years. A heavy infestation of the Mexican cotton boll weevil and a drought during June, July, and early August caused the yield of cotton to be somewhat below the average.

The yields of all crops except oats were lower than those obtained in 1914, but the yields of all except cotton and milo were higher than the average yields of the crops for the 6-year period from 1909 to 1914, inclusive. Table II shows the crops grown in the rotation

[1] This work is under the direct charge of Mr. C. R. Letteer, who prepared this report.

experiments, the number of plats planted to each crop, and the highest, lowest, and average yields per acre in 1915, as well as the average yields of the various crops for the 6-year period from 1909 to 1914, inclusive.

TABLE II.—*Yields per acre of crops in the rotation experiments at the San Antonio Experiment Farm, 1909 to 1915, inclusive.*

Crop.	Unit of yield.	Average yield, 1909 to 1914, inclusive.	Number of plats, 1915.	Yield in 1915.		
				Highest.	Lowest.	Average.
Corn	Bushel	25.0	21	43.6	15.3	30.3
Dwarf milo	do	[1] 42.2	14	39.7	5.4	22.8
Oats for grain	do	12.2	8	30.4	9.7	19.5
Cotton (in the seed)	Pound	576.5	30	836	404	567
Sorghum:						
4.1-foot drills	Ton	4.23	5	6.09	4.75	5.31
8-inch drills	do	4.54	7	9.15	4.21	7.22
Sudan grass	do	[2] 6.50	2	6.48	6.00	6.24
Oats for hay	do	1.51	8	2.35	2.10	2.22

[1] 1912 to 1914, inclusive. [2] 1913 and 1914.

The rotation experiments have not yet been carried on for a sufficient length of time to justify the drawing of definite conclusions as to which rotations are best suited to the conditions of the region. Results from the experiments indicate that thus far the time of plowing has been of more consequence than the effect of the preceding crop. It appears desirable that plowing should be done early, at least before January of the year in which the crop is to be planted. Cotton and corn generally give inferior results when planted following a crop of sorghum, the stubble of which is usually plowed during December or January. The sorghum crop continues growth until killed by frost and consequently dries out the soil to such an extent that it takes a long time for the soil to get into good condition again. On account of the relationship of the season to plowing and other cultural operations, a long series of years will be required to determine definitely the best rotation practices, but some results have been secured which are believed to contain valuable suggestions.

Methods of preparation.—The method of preparation usually employed on the experiment farm includes plowing the land to a depth of about 8 inches as soon as convenient after the removal of the previous crop. An earth mulch is then maintained, and the land is kept free from weeds by occasional harrowing or disking. In only one rotation, a 2-year rotation of corn and cotton, is any other method of preparation used. In that rotation the corn ground is not plowed in preparation for the cotton, but is disked as soon as possible after the corn is harvested, and usually it is disked two or three times more before the time for planting cotton the following spring. The cotton land is plowed to a depth of about 8 inches in

preparation for the corn crop, so that the land in this rotation is plowed once in two years. Adjacent to this rotation is one which is similar except that the land is plowed in February preceding each crop. A comparison of disking corn stubble as a preparation for cotton may therefore be made with spring plowing as preparation for cotton. In 1915 the cotton on disked corn ground yielded at the rate of 696 pounds of seed cotton per acre, while cotton on spring-plowed corn ground yielded at the rate of 464 pounds of seed cotton per acre. The average yield of seed cotton per acre in the rotation where cotton was grown on disked corn land for the 6-year period from 1910 to 1915, inclusive, was 661 pounds, as compared with 592 pounds in the rotation in which cotton was grown on spring-plowed corn land and 629 pounds in the rotation where cotton was planted on corn land plowed in August of the preceding year. Considering the fact that the cost of disking is much less than that of plowing, it appears that disking might often take the place of plowing, with the result of greater economy in growing the crop, and that fall disking of land may be preferable to spring plowing.

Subsoiling.—The rotation and tillage experiments include numerous tests on the effect of subsoiling in preparation for various crops. A report on this feature of the work was prepared and published in February, 1913.[1] The results obtained since that time corroborate the conclusions then published. The effect of subsoiling on the various crops has been variable, increasing the yields in some instances and decreasing them in others. In no case, however, has the increased yield been sufficient to offset the extra cost of subsoiling; usually the difference has been insignificant. In 1915 subsoiling decreased slightly the yields of all crops. In the 6-year period 1910 to 1915, inclusive, the average yields from all crops were slightly less on land subsoiled than on land not so treated.

Manuring.—The effect of manuring on crop yields has been tested in a number of the rotations. Wherever manure has been used it has been applied at the rate of about 16 tons per acre. A portion of the manure used has been that produced on the experiment farm, which is hauled from the corrals at frequent intervals and composted and then hauled to the field during the fall and winter months. This manure is largely the droppings of work horses, with a small amount from milk cows, and other waste material suitable for composting. The remainder of the manure used has been secured from near-by dairies. The manure from this source has been well rotted and has contained little straw or other coarse material, the practice in the locality being to keep dairy cows in corrals where no bedding material is used.

[1] Hastings, S. H., and Letteer, C. R. Experiments in subsoiling at San Antonio *In* U. S. Dept. Agr., Bur. Plant Indus. Cir. 114, p. 9-14. 1913.

The effect of manure on the yields of crops has varied with the crop and the season. Manure has shown more beneficial results on land used continuously for the same crops than where crops are grown in rotation. It has had a more favorable effect on the yields of cotton than on those of corn and other crops. In none of the tests with manuring have the increased yields been sufficient as yet to justify the expense of the treatment. As the rotation experiments have been conducted for a period of only 6 years, and as the soil at the experiment farm was originally very productive, it is not to be expected that marked differences would be obtained in the various experiments the first few years.

Green-manure crops.—Three different plants are being used as green-manure crops in the rotation experiments. Cowpeas and rye have been grown since the inauguration of these experiments in 1909, and field peas have been grown since 1913. Cowpeas are grown as a summer crop following oats, and field peas and rye are grown as winter crops. On account of drought during the summer months it has generally been impossible to grow a crop of cowpeas following another crop. In only two years out of seven has it been possible to grow cowpeas after oats to a size sufficient to have any value for green manuring. It has not been possible to grow a crop of cowpeas during any season after the removal of a corn crop. On this account the growth of cowpeas has been discontinued in all rotations except two. In these two rotations cowpeas are planted after the oat crop is removed. Field peas were substituted for the cowpeas in two rotations in 1913 and included in four new rotations started in that year, so that field peas are now grown on six plats each year. Rye is grown as a green-manure crop in one rotation.

Field peas planted in the fall of 1914 made good growth during the winter and a heavy crop was turned under in the spring of 1915. Estimates of the quantity of green material were made by weighing the vines from four areas, 4 by 4 feet on each plat, just previous to plowing under. The maximum estimated quantity of green material on any plat was 14.8 tons per acre; the minimum was 6.3 tons per acre, and the average on five plats was 10.6 tons per acre. The field peas on one plat were cut for hay and yielded at the rate of 2,888 pounds of field-cured hay per acre. These yields indicate the value of this crop for green-manure purposes or for the production of green forage. The behavior of the plats where green manure has been plowed under is about the same as that of plats where stable manure has been applied. Some increased yields have resulted, especially where field peas have been used. The results from plowing under rye have not been satisfactory. Thus far, the cotton yields have been less from the plat where rye was plowed in than in similar rotations where no green manure was used.

Biennial cropping and fallowing.—The results from biennial cropping and fallowing in 1915 were similar to those secured in previous years and already reported.[1] Growing a crop in alternate years with clean fallow between crops has not been a profitable practice in the production of corn, cotton, or oats for grain. It has resulted in lowering the yields of both corn and cotton, as compared with the yields of these crops grown continuously on comparable plats, and while it has generally increased the yield of oats for grain the increases have not been sufficient to justify the extra cost of biennial cropping. During the 5-year period from 1911 to 1915, inclusive, corn and cotton made lower yields on biennially cropped land than on land cropped annually, and oats made a higher yield. With the exception of oats the yields of crops on both biennially and annually cropped land have been less than the average of all plats used in the rotation experiments for each crop.

Effect of rotation and tillage on root-rot in cotton.—In a previous report,[2] attention was called to the effect of rotation and tillage practices on the prevalence of root-rot in cotton. Root-rot is one of the most serious problems with which farmers in the San Antonio region have to contend. It not only does much damage in cotton fields, but also attacks many other plants, notably alfalfa, and nearly all fruit and ornamental trees. It has been found in the rotation experiments that root-rot is less serious in cotton grown in rotation with other crops, such as corn or oats, than when the same land is used continuously for cotton production. Each year since 1913 actual counts of the total number of cotton plants on each plat and of the number which died from root-rot on each plat have been made. On a plat which has been cropped continuously to cotton for 7 years, 25.7 per cent of the plants died from root-rot by the time the first picking of cotton was made in 1915. The damage from root-rot on this plat has increased each year. Only 17.6 per cent of the plants died from root-rot in 1914, only 3.8 per cent in 1913, and in 1912 only about 1 per cent. A count of the plants dead from root-rot at the time of the second picking of cotton in 1915, about 6 weeks after the first count was made, showed that 49.7 per cent of the total number of plants had died. On plats where the cotton has been grown in rotation with other crops, but which have had the same treatment in other respects as the continuously cropped plat, practically no increase in the amount of root-rot infection has occurred. In fact, there has been little or no root-rot

[1] Hastings, S. H. The work of the San Antonio Experiment Farm in 1913. U. S. Dept. Agr., Bur. Plant Indus. [Misc. Pub.], 15 p., 5 fig. Sept. 9, 1914.

Hastings, S. H. The work of the San Antonio Experiment Farm in 1914. U. S. Dept. Agr., Bur. Plant Indus., West Irrig. Agr. 5 [Misc. Pub.], 16 p., 6 fig. 1915.

Letteer, C. R. Experiments in crop production on fallow land at San Antonio. U. S. Dept. Agr. Bul. 151, 10 p., 4 fig. 1914.

[2] Hastings, S. H. The work of the San Antonio Experiment Farm in 1912. *In* U. S. Dept. Agr., Bur. Plant Indus. Cir. 120, p. 13.

damage on any plats where cotton has been grown on fall-plowed land in rotations including corn, sorghum, or oats.

On another plat adjacent to the one mentioned above, on which cotton has been grown continuously for 7 years, but which has received an application of about 16 tons of manure annually, the spread of root-rot has been much less rapid. On this plat only 5.3 per cent of the plants died from root-rot in 1915 previous to the first picking of cotton, only 2.5 per cent in 1914, and only 0.83 per cent in 1913. These results indicate that the application of barnyard manure has had a tendency to check the spread of the disease.

Root-rot in cotton is apparently more troublesome on spring-plowed land than on fall-plowed land, even when the cotton is grown in rotation with corn. In a 2-year rotation of corn and cotton where the land was plowed in February, 15.4 per cent of the plants died from root-rot previous to the first picking of cotton in 1915, 12.8 per cent in 1914, and 13.2 per cent in 1913. In a similar rotation where fall plowing is practiced no plants died from root-rot in 1915 or 1914, and only 0.04 per cent in 1913. Subsoiling spring-plowed land seems to lessen slightly the damage done by root-rot. In a 2-year rotation of corn and cotton, where subsoiling is done in February each year, 3.2 per cent of the plants died from root-rot by the time the first picking of cotton was made in 1915, 4.8 per cent in 1914, and 1.6 per cent in 1913. This rotation is directly comparable with the one already mentioned where spring plowing is practiced. By comparing the root-rot damage in the two rotations it is seen that the subsoiling has a tendency to reduce the injury in cotton grown on spring-plowed land. It is very unlikely, however, that the effect of subsoiling in this connection would offset the increased cost of subsoiling.

EXPERIMENTS WITH CORN.

Variety test.—The Office of Corn Investigations[1] has conducted experimental work at the San Antonio farm since 1908, with the exception of the year 1913. The experiments have consisted largely in variety testing. The results obtained from some of the better known Texas varieties are given in Table III, which shows for each year the total number of varieties tested, the yield in bushels per acre, the maximum yield, and the average yield of the complete series. It also shows the average yields for the period.

The varieties that have outyielded those listed in the table have been in some instances, as in 1908 and in 1910, corn of mixed breeding, seed of which could not be obtained for a second year's test, or, as in 1911, largely foreign varieties, the small quantity of seed of which did not permit a second test. In 1912 seed of a number of the varieties that had been tested in previous years was not obtained

[1] The following report on the variety test was made by Mr. E. B. Brown, of the Office of Corn Investigations.

in time for planting. In 1914 a large number of foreign varieties were grown but none proved to be productive. The other varieties in the test were chiefly first-generation crosses checked with their common male parent, the Laguna. These crosses were all productive, and 13 out of the 14 tested outyielded the Laguna variety. This causes the rank of the pure varieties for 1914 listed in Table III to be comparatively low. In 1915 the variety test was more in the nature of an adaptation test. The varieties in the test represented the different corn-growing sections of the United States. The season was such that the early-maturing varieties had the advantage, and for the most part they outyielded the later maturing varieties.

TABLE III.—*Corn varieties tested at the San Antonio Experiment Farm by the Office of Corn Investigations.*

[In 1909, 75 varieties were planted, but none made grain. In 1913 the Office of Corn Investigations conducted no experimental work at the San Antonio Farm.]

Variety.	1908[1]		1910[2]		1911[3]		1912[4]	
	Rank as to yield.	Bushels per acre.	Rank as to yield.	Bushels per acre.	Rank as to yield.	Bushels per acre.	Rank as to yield.	Bushels per acre.
Highest yield in test	.....	60.0	.....	6.4	.....	11.2	.....	36.0
Laguna	2	56.0	3	3.7	10	6.2	2	35.4
Schieberle (U. S. Selection 170)	3	54.0	10	.1	25	2.3	(5)	.....
Ferguson Yellow	6	51.0	8	1.3	23	3.0	(5)	.....
Texas Gourd Seed	6	51.0	10	.1	22	3.3	(5)	.....
Singleton	7	50.0	4	3.1	19	4.5	(5)	.....
Chisholm	13	44.0	7	2.0	3	9.6	1	36.4
U. S. Cross 165	(5)	.....	1	6.4	11	6.1	10	29.1
Surecropper	(5)	.....	6	2.3	(5)	.....	9	30.1
Brazos	(5)	.....	(5)	.....	16	5.2	5	35.5
Old Glory	(5)	.....	(5)	.....	15	5.3	8	32.3
Average yield of complete test	.....	43.8	.....	2.2	.....	3.6	.....	29.7

Variety.	1914[6]		1915[7]		Total number of tests made.	Average of yields, 1908–1915.	Rank.
	Rank as to yield.	Bushels per acre.	Rank as to yield.	Bushels per acre.			
Highest yield in test	.....	51.6	.....	34.1	6	33.2	.....
Laguna	16	41.5	7	23.9	6	27.8	1
Schieberle (U. S. Selection 170)	(5)	.....	14	20.7	4	19.3	7
Ferguson Yellow	(5)	.....	(5)	.....	3	18.4	8
Texas Gourd Seed	(5)	.....	(5)	.....	3	18.1	9
Singleton	(5)	.....	4	28.6	4	21.5	6
Chisholm	(5)	.....	13	22.3	5	22.9	5
U. S. Cross 165	(5)	.....	17	19.4	4	15.2	10
Surecropper	19	38.1	2	30.8	4	25.3	4
Brazos	13	43.2	8	23.6	4	26.9	2
Old Glory	18	39.3	3	30.2	4	26.8	3
Average yield of complete test	.....	[8] 42.6	.....	18.9	6	23.5	.....

[1] Test included 63 varieties.
[2] Test included 17 varieties.
[3] Test included 50 varieties.
[4] Test included 16 varieties.
[5] Not in test.
[6] Test included 24 native and 71 foreign varieties.
[7] Test included 35 varieties.
[8] The 71 foreign varieties tested made practically no yields, and are not included in computing average yield.

The highest yield of the varieties listed was made by the Laguna, followed by the Brazos, a Laguna cross, and the Old Glory, another cross with Laguna. Everything considered, the Laguna has been the most satisfactory for this region of all the varieties tested. Its vigorous growth, stout stalk, coarse texture of leaf and husk, extensive root system, and yields make it especially valuable in this section, where adverse conditions frequently prevail. There are seasons, however, when earlier maturing varieties are better suited to the conditions prevailing and are more productive than the Laguna. A method that would combine early-maturing varieties with the Laguna variety in one planting would be expected to utilize more efficiently the moisture available and increase the chances of making a crop. Preliminary investigations have indicated that substantial increases in yields may be obtained by a combination planting of early-maturing and late-maturing varieties, as compared with the planting of either an early-maturing or a late-maturing variety alone.

Corn and cowpeas.—Planting corn in rows farther apart than the ordinary distance has been advocated as a desirable practice for semiarid regions. In certain sections the planting of a row of cowpeas between the wide-spaced corn rows has been practiced. In 1914 a preliminary experiment in increasing the distance between corn rows and planting a row of cowpeas between was carried out and the results published.[1] In 1915 a more elaborate experiment was conducted. The experiment was made on field C3 on land in oats the previous season and which had been plowed during the fall of 1914. It involved 11 plats, each plat containing 10 rows 132 feet long. Cowpeas were planted between the corn rows in plats 7, 8, and 9 on May 17, when the corn plants were about 2 feet high. In plats 10 and 11, cowpeas were planted March 26, before the corn came up. No cowpeas were planted in the remaining six plats. All the corn was planted thickly on all plats on March 13. On plat 1 the plants were thinned to 2 feet within the row, which is about the customary distance in this section. On the remaining plats the plants were left sufficiently close within the row to obtain as nearly as possible the same number of plants per acre as on plat 1. In other words, it was desired to have approximately the same number of plants per acre on all plats, but to have the distance between the rows vary from 4 to 7 feet. There was actually considerable variation in the stand on the various plats. This was due to unfavorable weather at planting time, as a result of which it was very difficult to get the exact number of plants desired on the various plats. Table IV shows the results secured in this experiment.

[1] Hastings, S. H., 1914. Op. cit.

TABLE IV.—*Yields of corn in the corn and cowpea experiment, San Antonio Experiment Farm, 1915.*

Crop and plat.	Distance between rows.	Average distance between plants.	Average number of plants per acre.	Average yield.		
				Per row.	Per plant.	Per acre.
Corn alone:	*Feet.*	*Inches.*		*Pounds.*	*Pounds.*	*Bushels.*
1	4	28.3	4,480	23.2	0.42	26.5
2	5	22.5	4,653	31.6	.45	29.8
3	6	21.7	4,009	40.6	.56	31.9
4	7	18.3	4,078	54.5	.63	36.8
5	6	23.1	3,778	45.4	.66	35.7
6	7	22.3	3,351	41.5	.58	28.0
Cowpeas planted May 17:						
7	5	23.8	4,395	35.7	.54	33.7
8	6	23.0	3,789	47.4	.69	37.2
9	7	19.6	3,809	53.8	.67	36.3
Cowpeas planted March 26:						
10	6	21.8	3,998	44.1	.61	32.7
11	7	20.5	3,643	34.4	.45	23.1

It is seen that where no cowpeas were planted between the rows of corn, the yield of corn per acre rose generally as the distance between the rows increased. The highest yield was obtained on plat 4, where the rows were 7 feet apart and there were 4,078 plants per acre. The lowest yield was on plat 1, where the rows were 4 feet apart and there were 4,480 plants per acre. On plat 6, where the rows were 7 feet apart, a relatively low yield was obtained, due probably to the poor stand, there being only 3,351 plants per acre.

Where a row of cowpeas was planted between the corn rows, plat 8 gave the highest yield of corn. The rows in this plat were 6 feet apart. Plat 9, in which the rows were 7 feet apart, gave a slightly lower yield of corn than plat 8. An appreciably lower yield of corn was obtained on plats 10 and 11, on which the cowpeas were planted early.

When the yields of corn from plats 7, 8, and 9 are compared with those from plats 2, 3, and 4, it is seen that when the cowpeas were planted after the corn had a good start the growing of a row of cowpeas between the rows of corn did not lower the yield of corn. In two instances, where the rows were, respectively, 5 and 6 feet apart, the plats on which cowpeas were planted between the rows of corn gave slightly higher yields, but the differences were insignificant.

Except on plat 7, where the rows were 5 feet apart, the cowpeas germinated well and a fairly good stand was obtained. On plat 7 there was a very poor stand of cowpeas. The cowpeas on plats 10 and 11, planted on March 26, made considerable growth early in the summer, before the corn had grown to sufficient size to shade them or to compete with them for the moisture supply. The cowpeas on plats 7, 8, and 9 made very little growth until after the corn was mature. Timely rains came the first part of September, and after

that the cowpeas on all plats made rapid growth. On October 21 the cowpeas on all plats were harvested. At that time nearly all of the pods on plats 10 and 11 were mature, while the peas on plats 7, 8, and 9 were somewhat less mature.

All made a very good quality of hay, although it was observed that there were more pods on the vines on plats 10 and 11 than on the other plats.

Table V shows the yields of field-cured hay per acre obtained from the various plats.

TABLE V.—*Yields of cowpea hay in the corn and cowpea experiment at the San Antonio Experiment Farm in 1915.*

Crop and plat No.	Distance between rows.	Yield per acre.	Crop and plat No.	Distance between rows.	Yield per acre.
Cowpeas planted May 17:	*Feet.*	*Pounds.*	Cowpeas planted Mar. 26:	*Feet.*	*Pounds.*
7	5	79	10	6	2,090
8	6	1,056	11	7	1,619
9	7	1,024			

It is shown in Table V that a good yield of cowpea hay was secured from all plats except plat 7, where the corn rows were only 5 feet apart. Approximately a half ton of cowpea hay per acre was secured from each of plats 8 and 9, and according to the records of these two plats this was not produced at the expense of lowering the corn yield.

While the results of this experiment should not be taken as conclusive proof that the wide spacing of corn is the best practice under San Antonio conditions, they indicate that under the conditions prevailing in 1915 wide spacing had a slight advantage over the ordinary method of planting. The results of the experiment also indicate that where cowpeas are planted between the wide-spaced rows after the corn is well started the yield of corn is not reduced as a result, as under such conditions the cowpeas make very little growth until after the corn is mature. After the corn has reached maturity, if conditions are favorable the cowpeas grow rapidly. It might be a good farm practice to plant cowpeas between such wide-spaced corn rows, as the cost of seed required for planting is only $1 to $1.50 per acre, and a considerable quantity of cowpea hay can be produced at very slight cost. If the corn crop were to be hogged off, the planting of cowpeas would be still more desirable, as the vines would furnish nitrogenous food to balance the ration.

EXPERIMENTS WITH COTTON.

As in former years, the experiments with cotton were conducted in cooperation with the Office of Crop Acclimatization and Adaptation Investigations. Some varietal tests were continued, further studies

were made with regard to the acclimatization of certain introduced varieties, and considerable breeding work was done. An experiment was also made in order to determine the effect on yield and quality of lint where equal numbers of plants per acre were grown in rows at varying distances apart. The latter experiment was in two sections, one in which thinning was done early and one in which it was done late. There were 25 rows in each section, grouped in blocks of 5 rows each, making five blocks in all. The blocks were separated by guard rows. The rows in these blocks were, respectively, 3, 4, 5, 6, and 7 feet apart. The plants within the rows were spaced at distances necessary to retain uniformly the same number of plants per block. These distances were determined on the basis of 10,000 plants per acre and varied from 17.4 inches in the 3-foot rows to 7.8 inches in the 7-foot rows. A good stand made it possible to space the plants with reasonable accuracy. Thinning in one section was done on May 21, when the plants were 4 to 5 inches high and had two to four true leaves. In the adjoining section thinning was done much later, on June 8, when the plants were 12 to 14 inches high.

Owing to unusual boll-weevil infestation at flowering time, the results of this experiment are of comparatively little significance. It is of interest to note, however, that even under the unfavorable conditions which obtained, the yield of seed cotton per plant was about the same in all rows, regardless of width of row, spacing within the row, or time of thinning. Naturally, therefore, the estimated yields per acre showed little variation, since in all cases there were practically the same number of plants per acre. The yield per row increased with the distance between rows, being 11.9 per cent greater from the 7-foot rows than from the 3-foot rows; but the smaller number of rows per acre in the case of the 7-foot rows offset this advantage.

Another experiment was conducted in which the same number of plants per row (about 6 inches apart) were grown in rows 3, 4, 5, 6, and 7 feet apart. While thinning probably was done later and the plants were left closer together than was desirable, a comparison of the row yields is of interest. The average row yield of seed cotton increased with the distance between the rows. The average yield from the 7-foot rows was 124.8 ounces, as compared with 51.3 ounces from the 3-foot rows, a difference of 73.5 ounces, or about 59 per cent. This difference practically equalized the acre yield. These results indicate that under conditions of drought and weevil infestation there may be some cultural advantages in having wide rows.

FIELD-PEA TEST.

Previous reports [1] have detailed the experiments with the field pea and indicated its value in the region. The variety that has been grown at the experiment farm in the field plantings is the Golden Vine. This usually has given good satisfaction, making a luxuriant growth and being fairly hardy. For the purpose of determining whether a variety could be found superior to the Golden Vine, a collection of 75 varieties was tested [2] in duplicate 4-rod double rows during the winter of 1914–15. As only a small area of each variety was grown, it seemed inadvisable to report the yields on the acre basis. The winter being rather less severe than usual, no information could be secured regarding differences in hardiness, all varieties coming through the winter uninjured. A great difference was observed in the vegetative growth made. The Golden Vine variety was found to be above the average, but there were several varieties which appeared to give better yields. Among them were the Gray Winter (S. P. I. 16436), Kaiser (S. P. I. 17006), Archer (S. P. I. 22037), Wisconsin Blue (S. P. I. 22049), Andes (S. P. I. 23848), Dublany (S. P. I. 26819), French Gray (S. P. I. 27003), Blue Imperial (S. P. I. 29367), and Anderson (S. P. I. 29370). Of this list the Kaiser, Gray Winter, Wisconsin Blue, Andes, and Blue Imperial made an excellent growth and appeared to be very well adapted to the conditions.

It has been found that field peas do not fruit as heavily here as in the more northern latitudes, and it is doubtful whether the crop can be grown as profitably for seed as for forage or green-manure purposes. The experiments thus far indicate that seed for planting will have to be secured largely from localities where good yields can be obtained. The principal difficulty that has arisen in this connection is that of securing seed at satisfactory prices. It takes from 90 to 100 pounds to seed an acre, and the seed has so far cost 5 cents or more per pound. While the results at the experiment farm indicate that a farmer might afford to pay that price for the seed, this expense will necessarily prevent many farmers from growing the crop. It is believed that it is possible to make arrangements with growers in the North, where the seed can be produced advantageously, so that the local farmers can be supplied at more favorable prices.

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[1] Hastings, S. H. Forage-crop experiments at the San Antonio field station. U. S. Dept. Agr., Bur. Plant Indus. Circ. 106, 27 p., 4 pl., 1 fig. 1913.

Hastings, S. H. 1914. Op. cit.

[2] This test was conducted in cooperation with the Office of Forage-Crop Investigations, Bureau of Plant Industry.

HORTICULTURAL EXPERIMENTS.

Owing to the frost which occurred on March 22, 1915, the fruit crop was severely injured. Up to that time there was every indication that a heavy yield would be obtained, but the temperature fell to 24.5° F., and the peach crop was practically ruined. A number of the plum varieties that flowered later set fair crops of fruit. The persimmon crop was very light, owing to frost injury. Good crops of jujubes (*Zizyphus jujuba*) and Rusk citranges were secured. Additions were made to the varieties of peaches, plums, and some other fruits grown on the farm, as well as to the ornamental plantings.

FLAX EXPERIMENTS.[1]

Seed of 24 flax varieties was sent from the Office of Cereal Investigations to the San Antonio Experiment Farm in March, 1914, to be used in connection with flax tests conducted at several points in the South and Southwest. These varieties were chiefly recent introductions from Abyssinia, India, Turkey, and Chinese Turkestan, but some of the best northern varieties were also included. In 1914 they were all sown in short nursery rows and made promising growth.

From the results obtained at San Antonio and elsewhere during the summer of 1914, and because many of these varieties are grown as winter crops in the countries from which they were imported, it was decided to start a flax nursery at San Antonio in the fall of 1914. Small quantities of 12 varieties, only one of which was a northern strain, were seeded in nursery rows about 17 feet in length. In addition, a small field plat of Smyrna flax (C. I. No. 30) was seeded at the same time. The season was unusually wet and cold. Although several of the varieties in the nursery rows made a promising growth, they were not harvested, and no yields were recorded except from the field plat of C. I. No. 30, which yielded at the rate of 11.9 bushels per acre. C. I. No. 13, the only northern strain grown, appeared most promising early in May. If flax is to prove a valuable crop in this area, a variety must be obtained that will ripen early, before the summer heat and drought become severe. The results obtained in 1915 indicate that, for conditions similar to those at San Antonio, the northern-grown flax varieties, if sown in the winter, may prove as promising as the imported winter types. Some of the Indian and Abyssinian strains made early and normal growth. The Chinese Turkestan varieties were too late to be promising.

The results so far secured indicate that flax can be grown in this area as a fall-sown crop and that as an accessory cash crop to cotton and corn it gives indications of being valuable. Sufficient testing has not been conducted to determine the best variety, the proper time of seeding, or what can be expected from the crop. The work

[1] This report was furnished by Mr. C. H. Clark, of the Office of Cereal Investigations.

seemed of sufficient importance, however, to warrant a more extended test. Consequently, five varieties were seeded in field plats in the fall of 1915 and 12 were sown in 16-rod rows. A date-of-seeding test and a row-spacing test, the latter designed for a study of the development of basal branches, were also included.

OAT-PASTURING EXPERIMENT.

Oats were planted on five quarter-acre plats on field D3 on November 10, 1914. On account of the late planting, the oats grew slowly during the fall and winter, so that it was not possible to start pasturing until February 7, 1915. By this time, according to the pasturing schedule followed the previous season, pasturing would have been discontinued on plats 2 and 3. Therefore, plats 1, 2, and 3 were not pastured at all in 1915. Two milch cows were turned on plats 4 and 5 on February 7. They were removed from plat 4 on February 20, but were allowed to remain on plat 5 until March 10. At the time of removing the animals from plats 4 and 5, the oat plants were 2½ to 3 inches high.

The oats on plats 1, 2, 3, and 4 were harvested on May 11, while those on plat 5 were still green at that time and were not harvested until May 27. Very little lodging occurred on plats 1, 2, 3, or 4, but at harvest the oats on plat 5 were badly lodged. Table VI shows the yields of hay and grain obtained on the various plats.

TABLE VI.—*Yields of grain and hay obtained in the oat-pasturing experiment at the San Antonio Experiment Farm in 1915.*

Plat No.	Period pastured.	Height at maturity.	Yield per acre—	
			Straw and grain.	Grain.
		Inches.	*Pounds.*	*Bushels.*
1	Not pastured	30	4,360	32.6
2	do	32	4,340	30.3
3	do	35	4,268	31.9
4	Feb. 7 to Feb. 20	30	3,844	35.7
5	Feb. 7 to Mar. 10	24	1,072	11.5

The yields indicate that pasturing as late as March 10 had a detrimental effect upon the yield of both hay and grain. On the other hand, the plat pastured from February 7–20 made the highest yield of grain, but gave a slightly lower yield of hay than the plats which were not pastured at all.

Approved:

WM. A. TAYLOR,
Chief of Bureau.

MAY 15, 1916.

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